

Diabetes Insipidus

National Kidney and Urologic Diseases Information Clearinghouse



National
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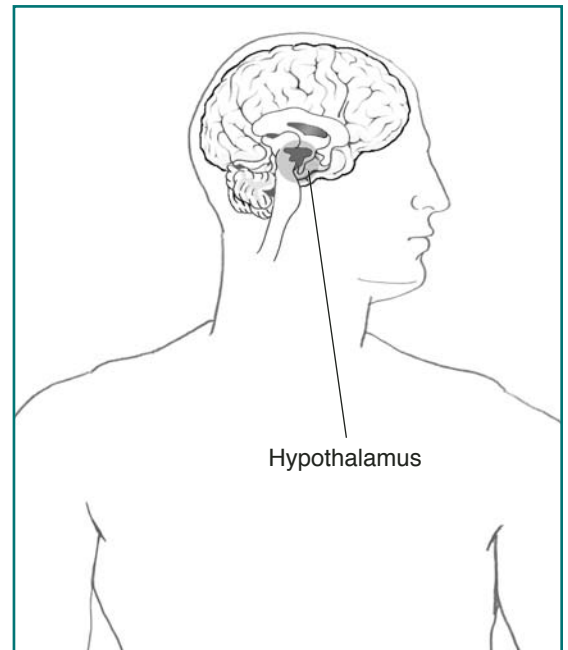
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Diabetes insipidus (DI) causes frequent urination. The large volume of urine is diluted, mostly water. To make up for lost water, you may feel the need to drink large amounts of water. You are likely to urinate frequently, even at night, which can disrupt sleep or, on occasion, cause bedwetting. Because of the excretion of abnormally large volumes of dilute urine, you may quickly become dehydrated if you do not drink enough water. Children with DI may be irritable or listless and may have fever, vomiting, or diarrhea. In its clinically significant forms, DI is a rare disease.

Diabetes Insipidus versus Diabetes Mellitus

DI should not be confused with diabetes mellitus, which results from insulin deficiency or resistance leading to high blood glucose. Diabetes insipidus and diabetes mellitus are unrelated, although they can have similar signs and symptoms, like excessive thirst and excessive urination.

Diabetes mellitus (DM) is far more common than DI and receives more news coverage. DM has two forms, referred to as type 1 diabetes (formerly called juvenile diabetes, or insulin-dependent diabetes mellitus, or IDDM) and type 2 diabetes (formerly called adult-onset diabetes, or noninsulin-dependent diabetes mellitus, or NIDDM). DI is a different form of illness altogether.



The hypothalamus makes antidiuretic hormone (ADH), which directs the kidneys to make less urine.

Normal Fluid Regulation in the Body

Your body has a complex system for balancing the volume and composition of body fluids. Your kidneys remove extra body fluids from your bloodstream. This fluid waste is stored in the bladder as urine. If your fluid regulation system is working properly, your kidneys make less urine to conserve fluid when the body is losing water. Your kidneys also make less urine at night when the body's metabolic processes are slower.



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In order to keep the volume and composition of body fluids balanced, the rate of fluid intake is governed by thirst, and the rate of excretion is governed by the production of antidiuretic hormone (ADH), also called vasopressin. This hormone is made in the hypothalamus, a small gland located in the base of the brain. ADH is stored in the nearby pituitary gland and released from it into the bloodstream when necessary. When ADH reaches the kidneys, it directs the kidneys to concentrate the urine by returning excess water to the bloodstream and therefore make less urine.

DI occurs when this precise system for regulating the kidneys' handling of fluids is disrupted. The most common form of clinically serious DI, central DI, results from damage to the pituitary gland, which disrupts the normal storage and release of ADH. Another form, nephrogenic DI, results when the kidneys are unable to respond to ADH. Rarer forms occur because of a defect in the thirst mechanism (dipsogenic DI) or during pregnancy (gestational DI).

Central DI

Damage to the pituitary gland can be caused by different diseases as well as by head injuries, neurosurgery, or genetic disorders. To treat the ADH deficiency that results from any kind of damage to the hypothalamus or pituitary, a synthetic hormone called desmopressin can be taken by an injection, a nasal spray, or a pill. While taking desmopressin, you should drink fluids or water only when you are thirsty and not at other times. This is because the drug prevents water excretion and water can build up now that your kidneys are making less urine and are less responsive to changes in body fluids.

Nephrogenic DI

The kidneys' ability to respond to ADH can be impaired by drugs (like lithium, for example) and by chronic disorders including polycystic kidney disease, sickle cell disease, kidney failure, partial blockage of the ureters, and inherited genetic disorders. Sometimes the cause of nephrogenic DI is never discovered.

Desmopressin will not work for this form of DI. Instead, you may be given a drug called hydrochlorothiazide (also called HCTZ) or indomethacin. HCTZ is sometimes combined with another drug called amiloride. The combination of HCTZ and amiloride is sold under the brand name Moduretic. Again, with this combination of drugs, you should drink fluids only when you are thirsty and not at other times.

Dipsogenic DI

A third type of DI is caused by a defect in or damage to the thirst mechanism, which is located in the hypothalamus. This defect results in an abnormal increase in thirst and fluid intake that suppresses ADH secretion and increases urine output. Desmopressin or other drugs should not be used to treat dipsogenic DI because they may decrease urine output but not thirst and fluid intake. This fluid "overload" can lead to water intoxication, a condition that lowers the concentration of sodium in the blood and can seriously damage the brain.

Gestational DI

A fourth type of DI occurs only during pregnancy. Gestational DI occurs when an enzyme made by the placenta destroys ADH in the mother. The placenta is the system of blood vessels and other tissue that develops with the fetus. The placenta allows exchange of nutrients and waste products between mother and fetus.

Most cases of gestational DI can be treated with desmopressin. In rare cases, however, an abnormality in the thirst mechanism causes gestational DI, and desmopressin should not be used.

Diagnosis

Because DM is more common and because DM and DI have similar symptoms, a health care provider may suspect that a patient with DI has DM. But testing should make the diagnosis clear.

Your physician must determine which type of DI is involved before proper treatment can begin. Diagnosis is based on a series of tests, including urinalysis and a fluid deprivation test.

Urinalysis is the physical and chemical examination of urine. The urine of a person with DI will be less concentrated. Therefore, the salt and waste concentrations are low, and the amount of water excreted is high. A physician evaluates the concentration of urine by measuring how many particles are in a kilogram of water (osmolality) or by comparing the weight of the urine to an equal volume of distilled water (specific gravity).

A fluid deprivation test helps determine whether DI is caused by (1) excessive intake of fluid, (2) a defect in ADH production, or (3) a defect in the kidneys' response to ADH. This test measures changes in body weight, urine output, and urine composition when fluids are withheld. Sometimes measuring blood levels of ADH during this test is also necessary.

In some patients, an MRI (magnetic resonance imaging) of the brain may be necessary as well.

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The National Kidney and Urologic Diseases Information Clearinghouse (NKUDIC) is a service of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). The NIDDK is part of the National Institutes of Health under the U.S. Department of Health and Human Services. Established in 1987, the Clearinghouse provides information about diseases of the kidneys and urologic system to people with kidney and urologic disorders and to their families, health care professionals, and the public. The NKUDIC answers inquiries, develops and distributes publications, and works closely with professional and patient organizations and Government agencies to coordinate resources about kidney and urologic diseases.

Publications produced by the Clearinghouse are carefully reviewed by both NIDDK scientists and outside experts. This fact sheet was also reviewed by Dr. Joseph Verbalis, Georgetown University, and Dr. Gary Robertson, Northwestern University.

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